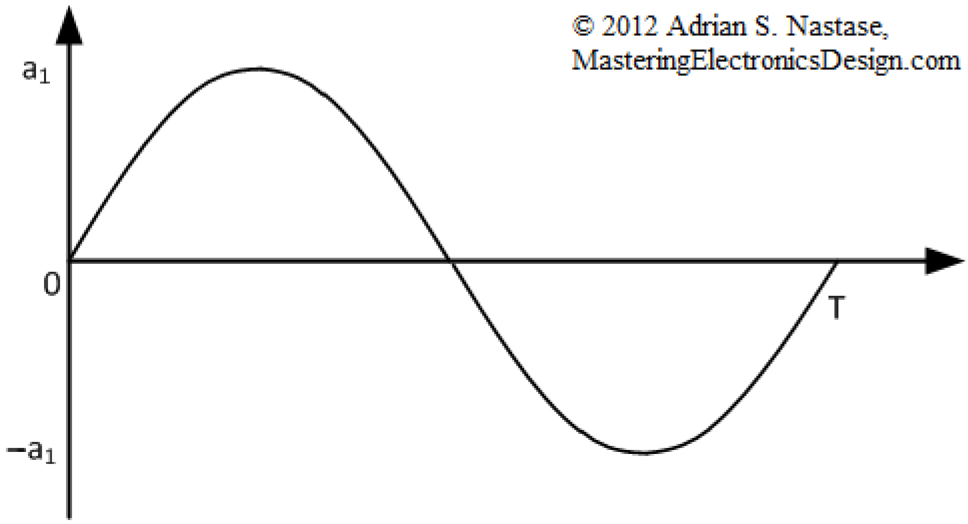
Instruments are cool. They can allow people to make music by moving their fingers and hands. But how do they work? First, we need to cover sound waves. Sound waves are, well, waves of energy that travel through whatever medium permitted. For example, sound moves through all three main forms of matter: Solids, Liquids, and Gases. Sound is really vibration, which transmits energy through the medium until it reaches the ear of an organism. But the ear doesn't do the work. It just makes the sound wave 'viewable' to the brain (like changing a file from a windows .exe to a mac .app or a .xcf to a .png or a .avi to a .mp4). The brain does all of the work, interpreting sound waves. Wave speed varies based on medium. For example, the speed of sound through air is 340.29 m/s or 761.2 mph. All waves through air at sea level travel at this speed. Waves travel fastest in solids and slowest in gases, leaving a middle speed in liquids. Waves in general have crests (the peak or compression), troughs (the lowest points or rarefaction), wavelengths, speeds, and frequencies. Each individual note has a different frequency, which leads to the difference in tone.

The Xylophone:
The xylophone works by striking it with some sort of object (like a mallet or a stick of wood. I also had fun hitting it with my phone. For the sake of realism, we used professional Glockenspiel mallets) then it makes a sound. This sound is made by displacing the air. The rubber bands around the xylophone keep the individual pipes raised off of the wood, but loose enough to vibrate the air. Since they are raised off and are barely touching anything, the xylophone can make the longest and clearest sound possible.The displaced air carries the energy of the pipe to your ear, where it is ‘reformatted’ so your brain can interpret it. The metal pipes are very resonant so they are pleasing and produce clear, long notes. Longer pipes displace more air, which leads to greater wavelengths and deeper notes.

Note	Frequency (Hz)	Multiply Longest Length By:	Length (cm)
C6	1046.50	1.0000	32.2
D6	1174.66	0.9428	30.2
E6	1318.51	0.8944	28.4
F6	1396.91	0.8660	27.8
G6	1567.98	0.8165	26.3
A6	1760.00	0.7746	24.5
B6	1975.53	0.7303	23
C7	2093.00	0.7071	22.4

The Basaxinet:

The Basaxinet consists of a 75 centimeter long rubber tube with a tenor saxaphone mouthpiece inserted into the tube. The instrument makes sound when the mouthpiece is blown into, vibrating the bamboo reed. the reed causes the air inside the instrument to vibrate at its natural frequency, amplifying the noise. The holes decrease the length of the wave, because the air escapes as early as possible; by plugging up the holes you increase the wavelength, and thus deepen the notes. Normally, a wind instrument would be very long if you used the entire wavelength, however because you create a high pressure zone where you blow, it takes a ¼ of a wavelength to decrease the pressure to normal, which quarters the wavelength. The length of a clarinet, for instance, is the wavelength of the deepest note / 4. Each hole is roughly ¼ of the wavelength away from the reed.



Note	Wavelength (cm)	Our ¼ Wavelength (cm)	Frequency (Hz)
A2	313.64	75	110
B2	279.42	71	123.47
C3	263.74	64	130.81
D3	234.96	57.4	46.831
E3	209.33	54.3	164.81
F3	197.58	48.8	174.61
G3	176.02	44.6	196

The reason for the instrument to be cut to the quarter of the sound wave length is that it takes a quarter of the wavelength to reach normal pressure (at the end of the tube) from high pressure (at the mouthpiece).